COARSE FREQUENCY OFFSET ESTIMATION

ABSTRACT

An orthogonal frequency division multiplexing (OFDM) receiver which digitally estimates and corrects for frequency offset and demodulates quadrature amplitude modulated (QAM) signals transmitted in the 5GHz frequency band embodies the current invention. Possible modulation types include binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 16-QAM, 64-QAM, (and 256-QAM in future standard enhancements). During the so-called short-preamble, the first few basic constituents are deliberately skipped. Then every 2.4 μs, a 1.6 μs duration sequence is collected until three such sequences are collected. Because the same waveform can be safely assumed to being repeated during all three sequences, any differences amongst the sequences are directly related to the frequency-offset error. The solution is set-up as a simultaneous-equation mathematical problem with a single unknown variable, a pseudo-rank of one. The maximum eigenvector is determined and used in the definition of an objective function. This objective function is computed for several possible steering vectors corresponding to different frequency offsets. The index of the maximum of the objective function serves an index into a pre-stored table of possible complex exponentials at differing frequencies. The frequency correcting cisoid is created by repeatedly multiplying the last element in the cisoid by all previous values to in essence double the length of the correcting cisoid. This method results in minimum table storage requirements and is quite well suited to vector processing.